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(54) Electrical installation using elongate insulators and protective assemblies therefor

(57) To protect an elongate electrical insulator from the atmosphere e.g. on an ocean going vessel, there is provided a hemispherical part 69 connected to one end of the insulator and a second part 81 connected to a different location on the insulator to provide a radial air gap AG, the parts 69, 81 being rotatable relative to one another. The rotatable part 69 is driven by vanes 75. In an alternative embodiment (Figs. 5 and 6 not shown) the hemispherical part (135) and the second part (139) are both fixed and a further cover (155, 157) is provided, rotating on a bearing (151) fixed to the second part and driven by vanes (171). The further cover provides a second radial air gap AG2.

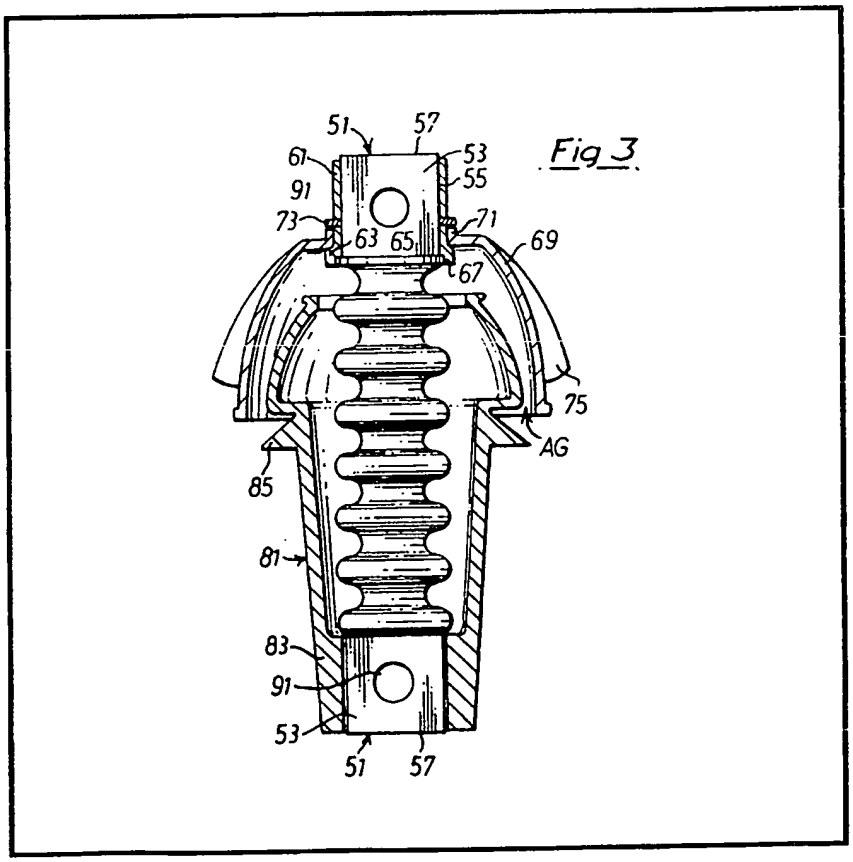

Fig 3.

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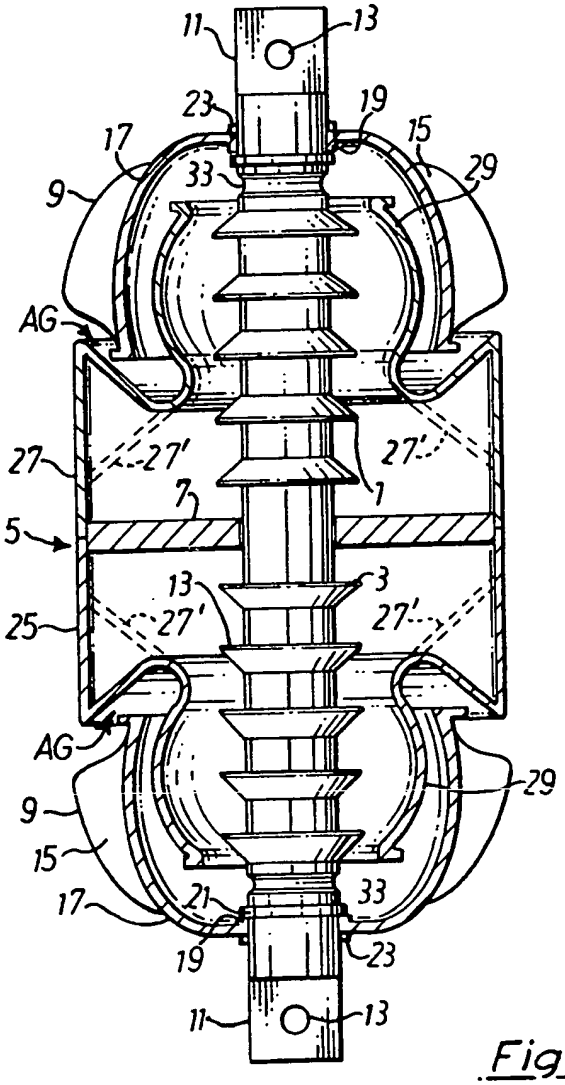

Fig 1

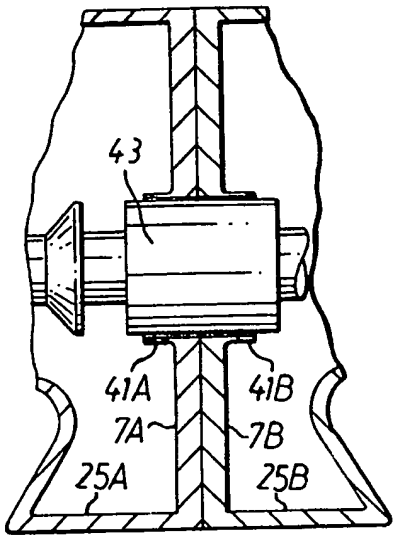

Fig 2

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Fig 3.

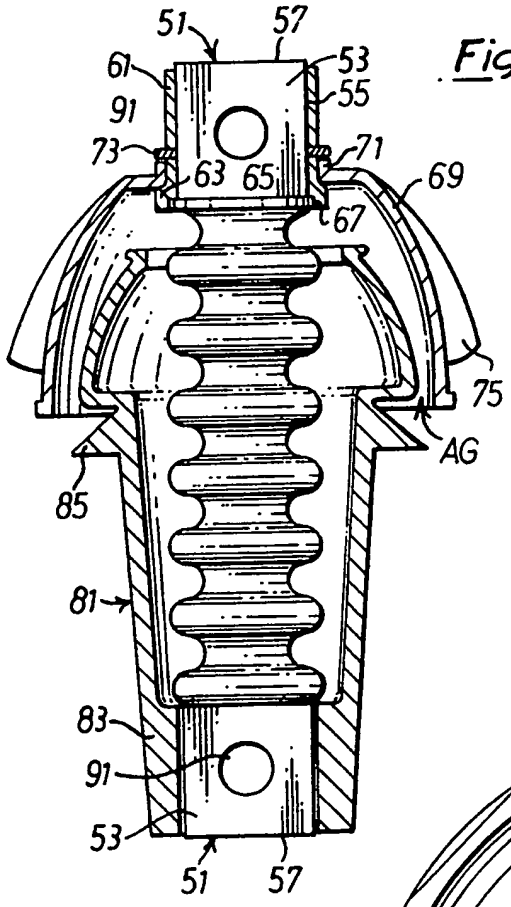
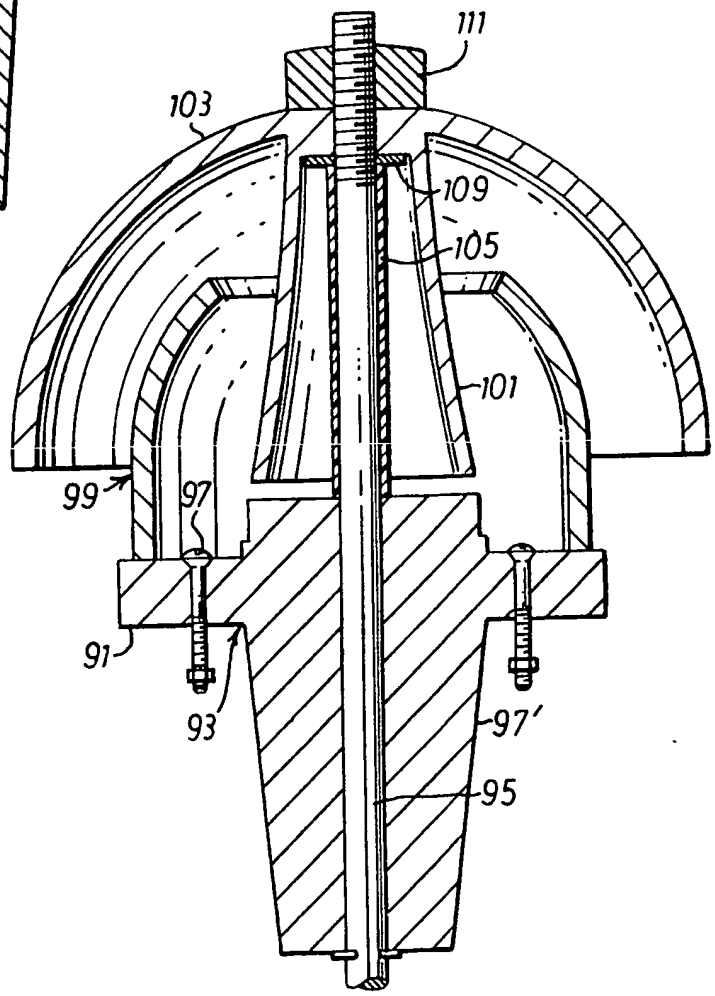


Fig 4.



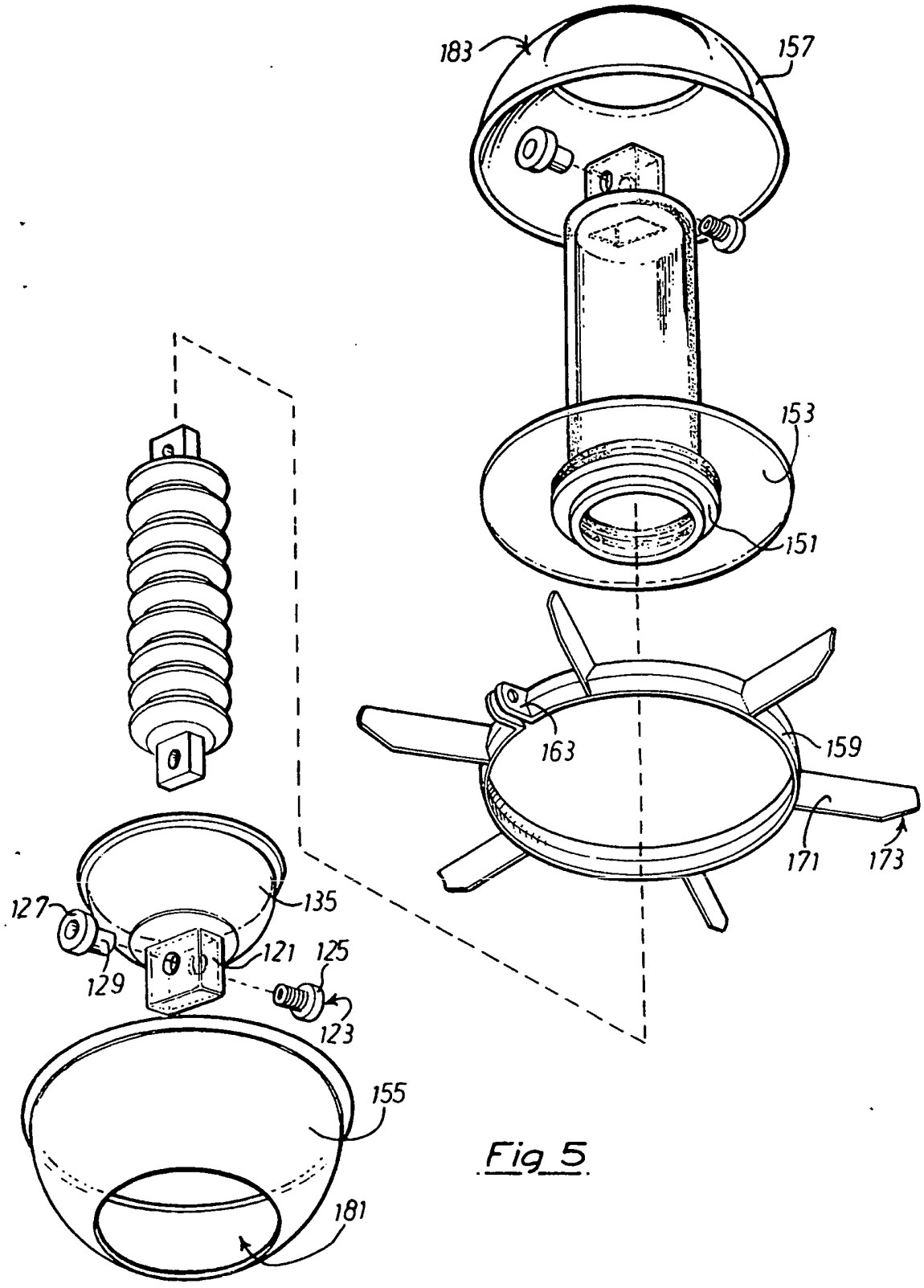


Fig 5

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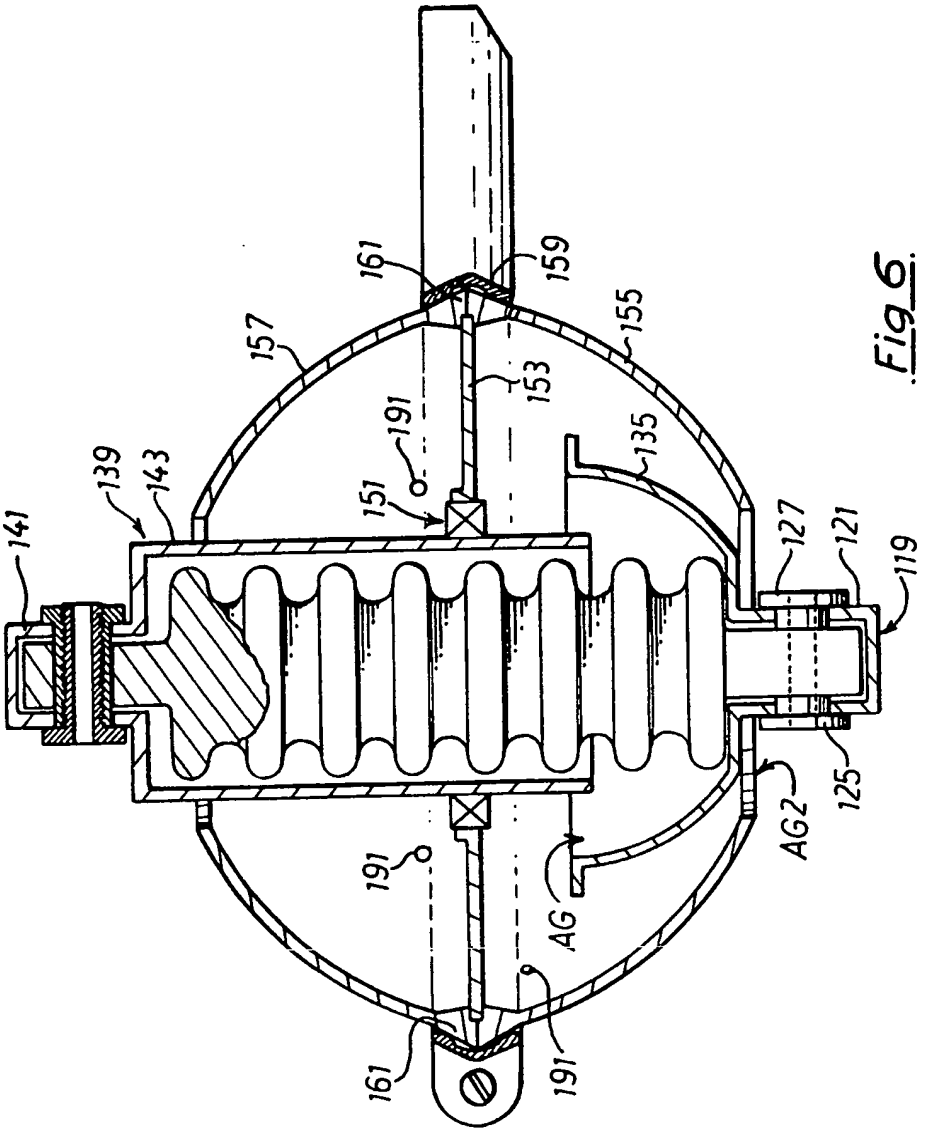

Fig 6.

SPECIFICATION

Electrical installation using elongate insulators and protective assemblies therefor

The present invention relates to an electrical installation such as a power line transmission installation or an ariel installation, employing elongate insulators; and to insulator protective assemblies for use in such installations.

A problem which arises in such installations is that of depositions forming on the insulators thereof from the atmosphere, which cause or increase current leakage along the surface of the insulators. This problem occurs especially with aerial installations on board ocean going ships.

It is an object of the present invention to provide an installation of the kind described above providing a better protection against short circuiting of the insulators than existing installations provide, and also to provide protective assemblies for the insulators of the installation, by which the better protection may be effected.

Generally, the insulators employed in an aerial installation are lead-in insulators through which an antenna wire is lead to the transmitter set, a suspension insulator (which may comprise a series of insulator bodies) one end of which is connected to a suspended antenna wire and the other end to a support and a strain or tension insulator which is used to dead end or break a support cable, or hold off the aerial wire from any obstruction. Similar insulators, particularly suspension insulators, are used in power line transmissions.

In one aspect of the present invention, there is provided a protective assembly for an elongate electrical insulator, the assembly being formed of component parts collectively completely to cover the insulator or a part thereof to be protected, the parts comprising a first part having means for mounting the part at or adjacent an end of the insulator and being of a general hemispherical shape to cover a portion of the insulator body with a radial separation therefrom, and a second part having means for securely connecting it with the insulator at a location remote from said end thereof and providing a portion to extend, when so mounted, towards the first part; wherein at least one of the first and second parts or the first and second parts and a further part, is or are rotatable about the axis of the insulator; and wherein the component parts form at least one air gap radially of the insulator.

In the case of a strain insulator protective assembly, the second part may comprise a base or end plate having means on the inner side thereof for mounting it on a respective end of the insulator and providing on the outer side thereof an anchorage point for a support or a hold-off cable or rope. In the case of a lead through insulator protective assembly, the second member may again comprise a base or end plate to receive a respective part of the insulator therethrough and having means for securing the second part to a support surface.

The insulator may be formed integrally with the second member or with the second and first members, but otherwise the base plate of the lead through insulator protective assembly would provide a through hole to receive the respective part of the insulator therethrough.

The present invention also provides a protective assembly for an elongate electrical insulator, the assembly being formed of component parts collectively completely to cover the insulator as a part thereof to be protected, the parts comprising a first part having means for mounting the part at or adjacent an end of the insulator and being of a general hemispherical shape to cover a portion of the insulator body with a radial separation therefrom, and a second part having means for securely connecting it with the insulator at a location remote from said end thereof and providing a portion to extend, when so mounted, into the first part; and being in the part to extend into the first part of complementary form thereof and to lie radially spaced from the insulator; wherein the first part comprises a sleeve located within the hemispherical part to pass in the axial direction of the insulator into the second part, whereby, when the assembly is mounted on the insulator, two air gaps are formed, namely between the hemispherical shape of the first part and the complementary form of the second part and between the second part and said sleeve.

A further provision of the present invention is an electrical installation using elongate insulators protected by protective assemblies according to the present invention.

Preferably, in the case of the assemblies for a lead-in insulator and a strain insulator, the base plate is an integrally formed member of the second part. It is also preferred that the rotatable part or one or more of them be vaned, and the vanes may extend radially outwardly of the assembly. The exterior or interior surfaces or both, of the cover parts may be roughened or profiled in some way to increase the surface area, for instance, by forming the exterior surface so that in longitudinal section it has a "Christmas tree" profile, known as sheds, or alternatively by forming the surfaces with dimples.

The second cover part preferably extends to or into the first part in which case, since they provide a spacing from one another radially of an insulator, they form an air gap between them, yet they completely enclose the protected part of the insulator. The further part may be arranged to provide a further air gap between it and the cover part other than the

one on which it is mounted.

In a particularly preferred form of the protective assembly, the vanes are of semi-circular form in cross section to extend radially outwardly of the assembly and with the diametrical direction of the vane lying in the direction of the axis of the insulator.

In the instance where the second cover part takes the form of a sleeve having an internal division, the two insulator bodies may be secured to the division by being rendered or formed integrally with the wall.

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:–

Figure 1 is a view of part of an aerial installation according to the present invention, showing in side elevational section a suspension insulator protective cover assembly according to the invention;

Figure 2 is a fragment showing a modification of the assembly referred to in connection with Fig. 1;

Figure 3 is a similar view to that of Fig. 1 showing an assembly for use as a strain or suspension insulator assembly;

Figure 4 is a sectional elevation of a lead-through insulator protective cover assembly according to the invention;

Figure 5 is an exploded view of a further protective cover assembly according to the invention; and

Figure 6 is a longitudinal cross section of the assembly of Fig. 5.

Referring now to Fig. 1 of the drawings, two in-line suspension insulator bodies 1, 3 are shown protected by a cover assembly generally indicated at 5. At their inner ends, the two bodies are integral with a transverse wall 7 of the cover assembly. The cover assembly comprises a first component part 9 in respect of each insulator body mounted on the respective insulator body adjacent the free end thereof on a shank portion 11 of the body; the shank portion bearing a hole 13 to take the shackle for an antenna wire or a support cable.

Each first part is of a general hemispherical shape and is formed with vanes 15 on its outer surface 17. Each first part is also rotatably mounted on the shank portion of the insulator body. For this purpose, each first part is formed with a boss 19, and each shank portion is formed with an annular flange 21 against which the inner end of the boss abuts. The shank is screw-threaded and receives a nut 23 thereon to prevent substantially axial displacement of the boss. The arrangement is such that the boss is able to rotate freely on the shank. To facilitate this, the surface of the shank between the flange and the nut, and the abutting surfaces of the boss, the flange and the nut, may be coated with or made of a low-friction material such as P.T.F.E. or each first part may be made of a material such as nylon, or a roller or ball bearing may be used.

The cover assembly comprises a further component part 25. The further part comprises the transverse wall 7 and a sleeve 27 providing end portions 29 extending within the respective first part radially inwardly thereof and of a complementary shape to the overlapping portion of the first part so as to leave an air gap AG between the overlapping portions.

The sleeve intermediate the overlapping end portions thereof is of a considerably increased diameter to increase the surface length in the longitudinal direction of the sleeve. The insulator bodies are formed with frusto conical flanges 31 for a like purpose.

An advantage of the illustrated protective assembly is the very considerable path length it presents to short circuiting deposits and the fact that a major portion of this path length is in the form of a protected surface. However, as an additional precaution against the ingress of rain or spray or humid air and travel thereof along an insulator body, each body adjacent the location of a first part of the cover assembly, is formed with an annular groove 33 so that water impinging on the top surface of an insulator body (as seen in Fig. 1) by passage through the respective air gap or forming thereon, will flow down in the groove, drip off therefrom and pass out via the inner surface of the first cover part.

The assembly may be used vertically suspended in which case, the sleeve portion thereof is preferably shaped as indicated in broken line at 27'.

One form of strain insulator may be regarded as being half the suspension insulator, that is, of terminating at the respective end with the transverse wall 7, which thus constitutes a base or end plate the outer side of which is provided with any suitable means for attaching a support cable thereto.

For ease of manufacture, the second component may be made in two parts 25A, 25B as shown in Fig. 2 and their respective end walls 7A, 7B welded or otherwise secured together; the end walls being formed with central apertures ringed by an annular flange 41A, 41B. The adjacent ends of the insulator bodies in this instance are integrally formed and bear a boss 43 which is sealed in the axial bore formed by the apertures in the end walls and the flanges 41A, 41B.

Alternatively, walls 7A, 7B may be formed as one part separately from the sleeve portions of parts 25A, 25B and then joined thereto.

The cover may be adapted for use with existing insulators and as shown in Fig. 3 a conventional insulator, namely, a Doulton type 164, is employed. This is formed with terminal shanks 51 which are part cylindrical so as

to provide flat parallel lateral walls 53 joined by arcuate side end faces 55 and a flat axial end surface 57. The first component part 59 of the cover is itself of a two-part structure comprising a sleeve 61 to fit over the shank at one end of the insulator. The sleeve generally is of a complementary section to that of the shank except that at its axially inward end, it is formed with a boss 63 providing a cylindrical bearing surface 65 and a terminal lip 67. The first component also comprises a hemispherical cover portion 69 formed at the apex thereof with an aperture ringed by an annular flange 71 the internal diameter of which is slightly larger than the exterior of the bearing suface 65. This cover part is passed over the sleeve until the shoulder formed by the flange 71 and the aperture seats on the lip 67, and is located in place by a suitable locking ring 73 (which could be of the jubilee clip type) secured around the boss. The inner face of the flange 71 seats on the bearing surface 65 to be able to rotate thereon. The hemispherical cover portion comprises vanes 75 to produce rotation of the cover portion under the effect of air movement.

The second part 81 is generally of the same form as described above but provides a sleeve 83 at its respective end to seat on the other shank of the insulator, and it provides an annular truncated cone-shaped flange 85 to obstruct direct axial access to the air gap AG between the first and second cover parts.

Each shank of the insulator and each sleeve of the cover are formed with a hole as indicated at 91 to take a bush and the pin (not shown) of a shackle for fixing an antenna wire or support cable to the shank. The shackle pin is used to hold the respective sleeve 61, 83 firmly in place on the shank. For this purpose, the bush receives a sleeve fitting round the shackle pin and providing at one end an annular flange to about against the facing surface of the sleeve of the respective component, and at its other end an internal screw thread to receive a cap nut also bearing an annular flange to bear against the opposite face of the component sleeve so that by tightening up the cap nut, the component sleeve can be held firmly in place.

The lead through insulator shown in Fig. 4 is generally similar to the strain insulator but, as may be seen from Fig. 4, the base plate 91 thereof is integrally formed with an insulator body 93 having a hole therethrough to accept a conductor rod 95. The base plate is perforated by four through holes to take fixing bolts 97 to fasten it to the support surface through which the conductor rod and a depending portion 97' of the insulator body pass. It also bears, radially inwardly of the sleeve 99, diametrically opposed slots (not shown) to provide for circulation of forced warm air.

Further, the first component of the cover comprises an inner skirt 101 passing within the sleeve 99; the skirt being moulded integrally with a hemispherical portion 103 of the first component. The conductor rod extends above the insulator body and is screwthreaded at its upper end (as seen in Fig. 4). A nut 109 is screwed thereon, and cover portion 103 is apertured at its apex to fit over the conductor rod and is integrally formed with a nut 111 which screws on the screw-threaded portion of the conductor rod until the underside of the boss sits on nut 109 to leave the rod extending above the hemispherical portion 103; the antenna wire being fixed to the extending part of the rod by any conventional means e.g. by the connector disclosed in copending application No. 7909504. The conductor rod in the length thereof between the insulator body and the cover portion 103 is coated with an insulating material 105.

Materials that may be used for the cover parts and/or insulators include thermoplastics such as PVC and materials such as polyvinylidene fluoride or chlorotrifluoroethylene and the material Teflon such as Teflon PFA, FEP and PTFE. However, an especially preferred material is a polycarbonate sold under the name "Lexan". "Teflon" is a Registered Trade Mark.

In the case where it is felt desirable to provide a rotatable cover part, it may be provided by a vaned annular member mounted on a fixed first part or a fixed second cover part. Thus, a second cover part such as shown in Fig. 3 may have rotatably mounted on the body portion thereof an externally vaned bulbous or dome shaped annulus such that the wall of the annulus lies radially outwardly of and covers the hemispherical cover portion of the first part. Thus, two air gaps are formed, one being an inner one formed between the fixed cover parts, and one being an outer one formed between the annulus and the first cover part. Preferably, in using this construction the body of the second part would be made of constant diameter, i.e. cylindrical, for convnience of mounting the vaned annulus thereon. In this construction also, the flange 85 as shown in Fig. 3 would be omitted and the first component part would be formed as an integral piece having a sleeve such as sleeve 83 shown in Fig. 3 rather than the sleeve 61 i.e. the first component part would be fixed.

An insulator assembly of this kind is shown in Figs. 5 and 6.

The first part 119 comprises a terminal sleeve portion 121, of rectangular section, comprising aligned bores to take a bush 123 of sufficient length to have the end remote from the head 125 thereof project from one side of the sleeve 121 when placed through the aligned bores with the head against the other side of the sleeve. The sleeve is then fastened in place by a nut 127 which may

have an extending portion 129 to pass round the shank of the bush and serve to pack the mounting hole 131 provided in the insulator 133. The first part also comprises a dome-shaped portion 135 contiguous with the sleeve so that the portion 135 covers part of the insulator body.

The second part 139 also comprises a terminal sleeve 141 identical to the portion 121 and a cylindrical sleeve 143 contiguous with portion 141 so that with the second part mounted on the insulator the end of the cylindrical sleeve remote from portion 141 lies within the dome of portion 135 of the first part, thus forming an air gap between the two parts.

The sleeve 143 adjacent the remote end carries the inner race of a ball bearing 151 the outer race of which is carried on the inner periphery of an annular flange member 153. The outer peripheral edge of the flange member is used to locate the rim of two hemispherical members 155 and 157; and those two members are held to the flange by a strap 159. For this purpose the rims of the two hemispherical members are formed to provide radially outwardly extending ridge 161, and the strap is of a complementary cross section, so that on tightening of the strap, the two members 155 and 157 are urged together. The strap may be fastened by any suitable means such as out-turned lugs 163 bearing holes to take a fastening bolt (not shown) secured in place by a nut (not shown).

The two hemispherical parts along with the flange member are therefore rotatable on the ball bearing, which preferably is one the races and ball cage of which are formed from an acetal polymer (an electrically non-conductive material) and the balls of which are formed of glass. Such bearings are produced by Bearings (Non Lube) Limited of Knaresborough, Yorkshire HG5 8LS.

The strap bears thereon to extend radially outwardly from the strap series of equiangularly spaced vanes 171. Each vane is of a semi-circular form in cross-section with the diameter of the cross-section lying in the direction of the axis of the insulator; and preferably each vane has a corner at its outward end removed as indicated at 173, that is, it is formed at the corner to provide a cross-section prgressively of a lesser arc than a semi-circle in the radially outward direction of the vane. It has been found that vanes of this shape produce a rotation of the hemispherical parts regardless of wind direction.

The hemispherical part 155 provides an aperture 181 at the axpex thereof to clear the first part of the cover, the aperture forming a second air gap AG 2 with the first part radially of the insulator body. The other hemispherical part 157 also has an aperture 183 at the apex thereof to permit it to rotate about the sleeve portion 143.

Each hemispherical part also comprises a series of holes 191. It has been found that due to the rotation of the hemispherical parts, water, e.g. rain, entering between sleeve 143 and hemispherical part 155 and between the domed portion of the first part and the other hemispherical member 157 is flung out from the interior walls of the hemispherical members through the holes.

In tests carried out with an insulator assembly as shown in Figs. 5 and 6, in both power line transmissions and in ariel installations, in weather conditions rapidly leading to a substantial loss of efficiency of an unprotected insulator, the assembly was found to give complete protection to the insulator.

In a modification of the embodiment of Figs. 5 and 6, the terminal sleeve 141 is omitted, and the cylindrical sleeve 143 is adapted to be fastened to the body of the insulator spaced from the respective end thereof. This may be done by a collar such as to permit it to be clamped to the insulator body and providing means to fix the respective end of the cylindrical sleeve to it in a substantially water-tight manner. The modification is useful where only a portion of the insulator needs to be protected.

Because of the protection afforded by a protective assembly of the invention, the insulator itself need not have the usual corrugated profile and may have a uniform cross-section throughout substantially its entire length, e.g. it may be of rod-like form.

CLAIMS

1. A protective assembly for an elongate electrical insulator, the assembly being formed of component parts collectively completely to cover the insulator or a part thereof to be protected, the parts comprising a first part having means for mounting the part at or adjacent an end of the insulator and being of a general hemispherical shape to cover a portion of the insulator body with a radial separation therefrom, and a second part having means for securely connecting it with the insulator at a location remote from said end thereof and providing a portion to extend, when so mounted, towards the first part wherein at least one of the first and second parts or the first and second parts and a further part, is or are rotatable about the axis of the insulator; and wherein the component parts form at least one air gap radially of the insulator.

2. An assembly according to claim 1 for use with a strain insulator, wherein the second part provides a base or end plate having means on the inner side thereof for mounting it on a respective end of the insulator and providing on the outer side thereof an anchorage part for a support or a hold-off cable or rope.

3. An assembly according to claim 1 for

use with a lead-through insulator, wherein the second part provides a base or end plate to receive therethrough a respective portion of the insulator and having means for securing the second part to a support surface.

4. An assembly according to claim 1 for use with a suspension insulator, wherein the second part comprises a sleeve to surround the respective portion of the insulator with a radial separation therefrom.

5. An assembly according to claim 4, wherein the sleeve extends to or into the first part to form an air gap therewith.

6. An assembly according to claim 4 or 5, employing said further part, wherein said further part is rotatable on the second part and is such as to form an air gap with the first part.

7. An assembly according to claim 6, wherein said further part is such as to lie radially outwardly of the first part.

8. A dual assembly for protecting two of the insulators to be used in-line, comprising an assembly according to any of preceding claims 4 to 7, for each insulator, wherein the two sleeves of the assemblies are integral and provide a transverse dividing wall, the two sides of which form a mounting for the two insulators respectively at the end thereof remote from the location of said first component mounting.

9. An assembly according to any of the preceding claims, wherein the rotatable part or one or more of them is vaned.

10. An assembly according to claim 9, wherein the vanes are disposed to extend radially outwardly of the assembly.

11. An assembly according to claim 10, wherein each vane is generally of a semi-circular cross-section and arranged to lie with the diameter thereof in the direction of the axis of the insulator.

12. An assembly according to claim 11, wherein at least one vane at a radially outer corner thereof is formed to provide a cross-section progressively of a lesser arc than a semi-circle in the radially outward direction of the vane.

13. A protective assembly substantially as hereinbefore described with reference to Figs. 1, 2, 3 or Figs. 5 and 6 of the accompanying drawings.

14. A protective assembly for an elongate electrical insulator, the assembly being formed of component parts collectively completely to cover the insulator or a part thereof to be protected, the parts comprising a first part having means for mounting the part at or adjacent an end of the insulator and being of a general hemispherical shape to cover a portion of the insulator body with a radial separation therefrom, and a second part having means for securely connecting it with the insulator at a location remote from said end thereof and providing a portion to extend, when so mounted, into the first part; and being in the part to extend into the first part of complementary form thereto and to lie radially spaced from the insulator; wherein the first part comprises a sleeve located within the hemispherical part to pass in the axial direction of the insulator into the second part, whereby, when the assembly is mounted on the insulator, two air gaps are formed, namely between the hemispherical shape of the first part and the complementary form of the second part and between the second part and said sleeve.

15. An assembly according to any of the preceding claims, wherein the second member is or the second and first members are integral with the insulator.

16. An assembly according to claims 14 and 15, wherein the second part comprises a base or end plate having a central boss constituting an insulator, the boss having a longitudinal hole formed therethrough to admit passage of an electrical conductor rod.

17. An assembly according to claim 16, wherein the conductor rod is sheathed with an electrical insulator between the boss and the first part of the assembly.

18. A protective assembly substantially as hereinbefore described with reference to Fig. 4 of the accompanying drawings.

19. An assembly according to any of the preceding claims, wherein the insulator is of a uniform cross-section throughout substantially its entire length.

20. An assembly according to claim 19, wherein the insulator is of rod-like form.

21. An electrical installation using elongate insulators, wherein the insulators are protected by a protective assembly according to any of the preceding claims.

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